[0001] This is a continuation-in-part of application serial number 10/016,062 filed November 15, 2001, now U.S. Patent No. 6,635,313 B2.

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FIELD OF THE INVENTION

[0002] The present invention is directed to a coated high strength dual phase steel product containing carbon, manganese and molybdenum where conventional hot-dip zinc coating is applied to the product using a galvanizing/galvannealing process having processing conditions normally employed for low and ultra low carbon steels that do not contain easily oxidized and intentionally added alloying elements such as manganese and silicon.

BACKGROUND ART

[0003] Earlier patents, that do not appear to anticipate the present invention, and therefore, are disclosed as background information, show that it is known to use conventional hot-dip galvanizing processes to apply conventional hot-dip zinc coatings to the surface of steels for corrosion protection. Such galvanizing processes generally involve heating a steel substrate under controlled conditions, immersing the steel into a molten bath of a coating metal such as zinc or a zinc alloy, and cooling the coated material for further downstream processing and/or subsequent use.

[0004] In one exemplary downstream process, known in the coating art as galvannealing, the conventional hot-dip zinc coated material is heated in an annealing furnace, and the reheated zinc coating reacts with the steel material at the interface of the substrate forming a zinc alloy coating on the base steel material during the annealing process. Such galvannealed material is advantageous in that the coated surface exhibits good paint-adherence properties.

[0005] One well-known problem related to the use of conventional hot-dip zinc-coating processes is that it is difficult to apply a good quality hot-dip zinc coating to high strength dual phase steels. In order to manufacture high strength steels, it is necessary to add strengthening alloys during the steelmaking process. In the present invention, where strengthening is achieved through the formation of a dual phase microstructure (ferrite plus, primarily martensite), it is necessary to make alloy additions with elements such as Mn, Si, Mo, and Cr. Many of these alloying elements can have a detrimental effect on the coating quality due to zinc dewetting when coated by hot-dip galvanizing. Elements such as Mn, Si, and Cr, that are easily oxidized, and therefore, are troublesome when they are

a) maintaining the same multi-zone reducing atmosphere furnace condition;

heating a high strength dual phase steel sheet in said multi-zone reducing atmosphere furnace;

c) applying a hot-dip zinc coating to at least one side of said steel sheet;

d) cooling said hot-dip zinc coated steel sheet to manufacture a zinc coated steel product having a zinc coated surface composition consisting essentially of by weight percent;

iron less than about 1.0%;

molybdenum less than about 0.002%;

aluminum between about 0.3 and 0.6%; and

manganese between about 0.01 and 0.10%.

17. The zinc coated steel product manufactured according to the process of claim 16, the composition of said high strength dual phase steel sheet consisting essentially of, in weight percent;

carbon between about 0.05 and 0.12%,

manganese between about 1.0 and 1.6%,

phosphorus up to 0.04%,

sulfur up to 0.02%,

silicon up to 0.10%,

molybdenum between about 0.15 and 0.35 %,

aluminum between about 0.01 and 0.08%, and

the balance being iron and incidental impurities.

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18. ~~19.~~ A zinc coated steel product manufactured according to the process of claim 16, wherein said zinc coated surface is a galvanized coated surface, the composition of said galvanized coated surface consisting essentially of by weight percent;

iron between about 0.2 and 1.0%,

molybdenum less than about 0.0005%,

aluminum between about 0.3 and 0.6%, and

manganese between about 0.01 and 0.10%.

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19. ~~20.~~ The process according to claim 16 including:

e) annealing said hot-dip zinc coated steel sheet, and

f) cooling said galvanneal coated steel sheet to manufacture a zinc coated steel product having a galvanneal coated surface composition consisting essentially of by weight percent;

iron above about 8.0%,

molybdenum less than about 0.035%,

aluminum between about 0.15 and 0.30%, and

manganese less than about 0.160%.

20.

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~~21~~ 19. A zinc coated steel product manufactured according to the process of claim ~~20~~ 19, the composition of said galvanneal coated surface consisting essentially of by weight percent;

iron above about 8.0%,

molybdenum between about 0.015 and 0.025%,

aluminum between about 0.15 and 0.30%, and

manganese between about 0.145 and 0.160%.